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PB-257 592

A REEXAMINATION OF THE COEUR D'ALENE RIVER, SEPTEMBER 1971

ENVIRONMENTAL PROTECTION AGENCY

NOVEMBER 1971

268006

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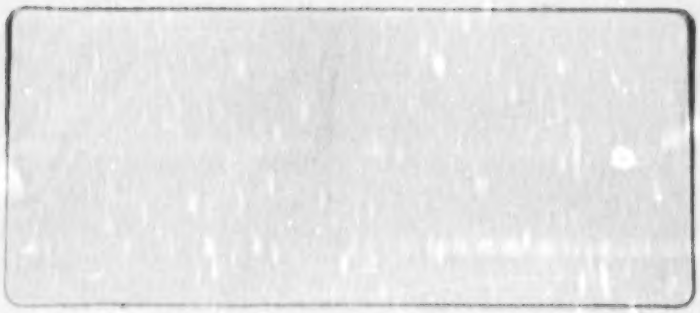

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BIBLIOGRAPHIC DATA SHEET	1. Report No.	2.	3. Recipient's Accession No. PB-257 592
4. Title and Subtitle A Reexamination of the Coeur d-Alene River, September 1971			5. Report Date Nov 71
			6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Environmental Protection Agency SEattle, Washington Region X			10. Project/Task/Work Unit No.
			11. Contract/Grant No.
12. Sponsoring Organization Name and Address			13. Type of Report & Period Covered
			14.

15. Supplementary Notes

16. Abstracts

In the 1971 survey, samples were collected in the Coeur d'Alene River and its tributaries above and below all major mine and mill discharges. Samples of the wastes from the various mines and mills were also collected for analyses. The quantity of metals being discharged and the quantities being carried by the streams at various monitoring stations have been calculated from streamflow data. The data are presented for each mining area in downstream order.

17a. Key Words and Document Analysis. 17a. Descriptors

*Mine waters,
*Water pollution,
*Coeur d Alene River,

Metals,
Surveys,
Mining,
Stream flow,
Mills,
Water analysis,
Tables (data),

17b. Identifiers/Open-Ended Terms

*Water quality data,
Tributaries.

17c. COSATI Field/Group 13 B 8 I

18. Availability Statement National Technical Information Service Springfield, Virginia 22161	19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 49p
	20. Security Class (This Page UNCLASSIFIED	22. Price 4.00/2.25

FORM NTIS-35 (REV. 10-73) ENDORSED BY ANSI AND UNESCO. THIS FORM MAY BE REPRODUCED USCOMM-DC 8265-P74

PB 257 592

A REEXAMINATION OF THE COEUR D'ALENE RIVER SEPTEMBER 1971

By

Jack E. Sceva

William Schmidt

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SPRINGFIELD, VA. 22161

ENVIRONMENTAL PROTECTION AGENCY
REGION X
SEATTLE, WASHINGTON
November 1971

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INTRODUCTION

The Environmental Protection Agency has periodically examined the quality of the Coeur d'Alene River to determine the effects of mine and mill wastes. This examination was conducted on September 22 and 23, 1971 as a supplement to the examination and report of May 1970 1/.

In the 1971 survey, samples were collected in the Coeur d'Alene River and its tributaries above and below all major mine and mill discharges. Samples of the wastes from the various mines and mills were also collected for analyses.

The quantity of metals being discharged and the quantities being carried by the streams at various monitoring stations have been calculated from streamflow data supplied by the U. S. Geological Survey or from flows measured by current meter.

The data is presented for each mining area in downstream order, starting with the Lucky Friday mine and mill at Mullan to the Bunker Hill operations at Kellogg. The analytical data and loading information for the South Fork of the Coeur d'Alene River are given on Table 10.

1/ Report on Coeur d'Alene River Survey, May 12-17, 1970. Environmental Protection Agency

ACKNOWLEDGEMENTS

We wish to acknowledge and thank the following mining companies and their staff for their help and cooperation in making this survey:

Day Mines Inc.

Hecla Mining Co.

American Smelting and Refining Co.

Sunshine Mining Co.

The Bunker Hill Co.

CONCLUSIONS

1. The Bunker Hill operations at Kellogg and Smelterville are by far, the largest source of metals being discharged to the Coeur d'Alene River.

2. The operations at the Lucky Friday, Dayrock, Consolidated Silver, Galena, Cresent, Sunshine Mines and the Hecla Mill have relatively minor effects on the Coeur d'Alene River but they do have some effect on tributary streams.

3. Ground water percolating through old tailings in the Canyon, Ninemile and Coeur d'Alene valleys dissolves substantial quantities of zinc and has a major effect on water quality in the Coeur d'Alene River Basin.

4. Raw sewage discharged to the South Fork Coeur d'Alene River and its tributaries appears to be a very serious public health problem.

5. The recent diversion of mercury laden waste streams at the Bunker Hill Zinc Plant to the Central Impoundment Area has been effective in removing most of the mercury from the Bunker Hill effluent.

RECOMMENDATIONS

1. The "Cleaning Up" of the Bunker Hill waste streams and the elimination of all raw sewage discharges should be our No. 1 priority for improving water quality in the Coeur d'Alene River Basin.

2. A survey is needed to determine the magnitude of bacteria contamination in the River.

LUCKY FRIDAY MINE AND MILL

The Lucky Friday Mine and Mill are located on the Northside of the Coeur d'Alene Valley just east of Mullan, and are operated by the Hecla Mining Company.

The mine waste, which includes both mine water and the waste from the sand filling operation is discharged into Gold Hunter Creek, which is tributary to the South Fork of the Coeur d'Alene. The flow of the mine waste at the time of our examination was about .6 cfs.

The mill wastes are piped to a tailings pond located just west of Mullan. The overflow from this pond normally discharges into the South Fork, but at the time of this examination there was no overflow due to the recent raising of the pond's decant pipe.

Figure 1 is a sketch map showing the location of the facilities and sampling stations in the Mullan area. The analytical data are given on Table 1.

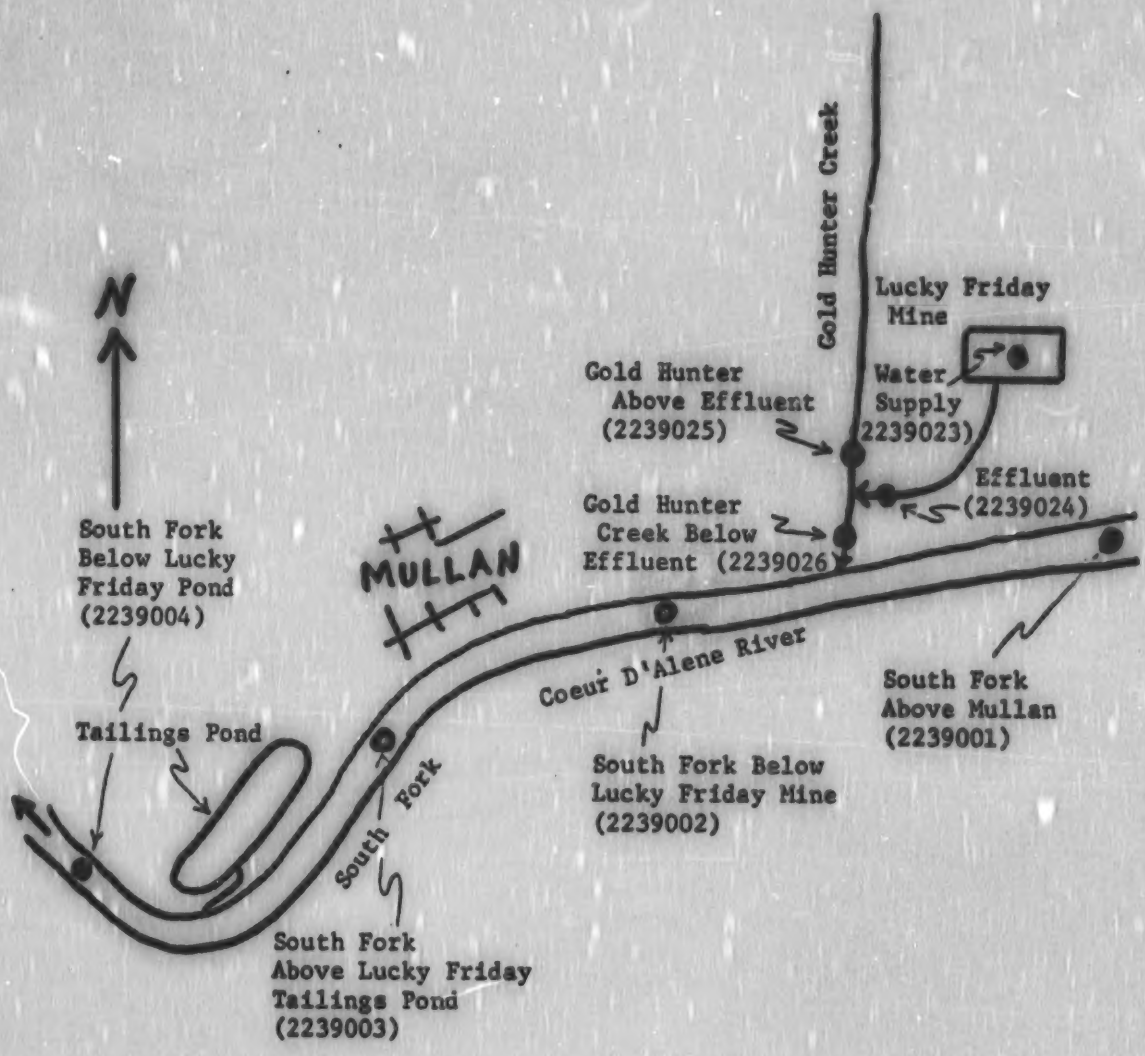

FIGURE 1

SKETCH MAP OF THE MULLAN AREA
SHOWING THE LUCKY FRIDAY MINE AND
SAMPLING STATIONS

TABLE 1

ANALYSIS OF WATER AND EFFLUENT AT THE
LUCKY FRIDAY MINE
September 23, 1971

Parameter	Water Supply Lucky Friday Mill (2239023)	Mine Effluent (2239024)	Gold Hunter Creek Above Mine Effluent (2239025)	Gold Hunter Creek Below Mine Effluent (2239026)
Conductivity, uMHO	110	740	225	440
pH	6.6	7.6	7.0	7.6
Antimony, Total, ug/1	30	110	50	80 (1)
Arsenic, Total, ug/1	< 5	21	< 5	14
Cadmium, Total, ug/1	1	2	1	1
Chromium, Total, ug/1	4	7	4	5
Copper, Total, ug/1	32	27	23	20
Lead, Total, ug/1	5	1,500	12	530 (7)
Mercury, Total, ug/1	5	5	5	5
Zinc, Total, ug/1	70	190	25	88 (1)
Flow, cfs		.6		2.6

(Load in pounds per day shown in parenthesis)

MORNING MINE TUNNEL

The Morning Mine is a large mine operated by the Hecla Mining Company. One portal is located along the north side of the Coeur d'Alene Valley just west of Mullan. Mine water is discharged to Slaughterhouse Creek, a small tributary to the South Fork of the Coeur d'Alene River. The combined flow of the mine water and Slaughterhouse Creek at the time of our examination was about .3 cfs.

Ore from the Morning Mine is hauled through underground workings to the portal at Burke where it is processed at the Hecla Mill.

Figure 2 shows the location of sampling stations at the Morning Mine portal near Mullan. The analytical data is given on Table 2.

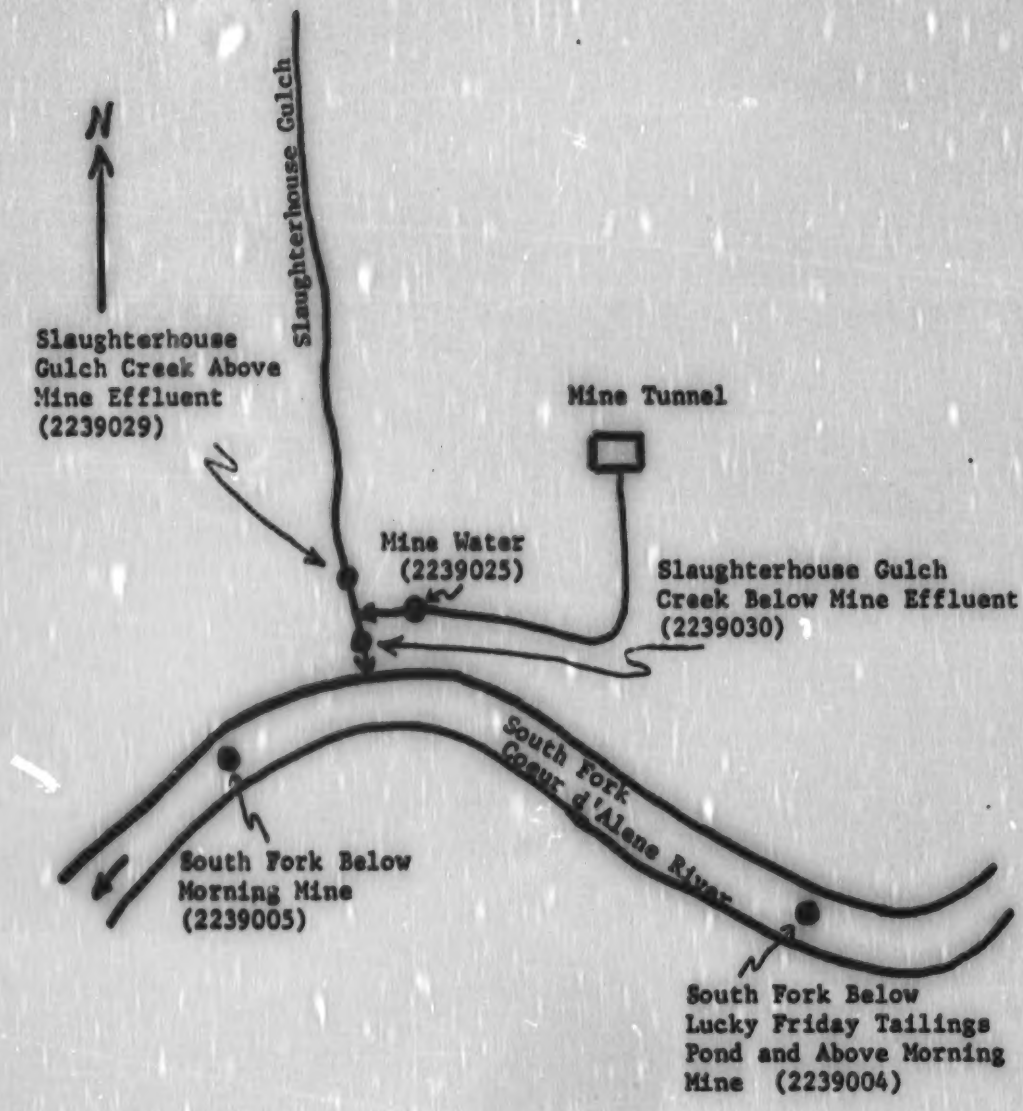
N
Slaughterhouse Gulch
Slaughterhouse Gulch Creek Above Mine Effluent (2239029)
Mine Tunnel
Mine Water (2239025)
Slaughterhouse Gulch Creek Below Mine Effluent (2239030)
South Fork Coeur d'Alene River
South Fork Below Morning Mine (2239005)
South Fork Below Lucky Friday Tailings Pond and Above Morning Mine (2239004)

FIGURE 2

SKETCH MAP SHOWING SAMPLING
STATIONS AT THE MORNING MINE TUNNEL

TABLE 2

ANALYSIS OF EFFLUENT AND WATER AT THE MORNING
MINE PORTAL NEAR MULLAN
September 23, 1971

	Effluent From Mine Tunnel (2239028)	Slaughterhouse Gulch Creek Above Mine Effluent (2239029)	Slaughterhouse Gulch Creek Below Mine Effluent (2239030)
Conductivity, uMHO	420	200	330
pH	7.3	7.2	7.0
Antimony, Total, ug/1	70	70	50
Arsenic, Total, ug/1	< 5	< 5	< 5
Cadmium, Total, ug/1	8	2	6
Chromium, Total, ug/1	5	5	5
Copper, Total, ug/1	11	2	10
Lead, Total, ug/1	225	9	330 (.5)
Mercury, Total, ug/1	1	1	.5
Zinc, Total, ug/1	700	250	690 (1)
Flow, cfs			.3

(Load in pounds per day shown in parenthesis)

HECLA MILL

Ore from the Star and Morning Mines is hauled through underground workings to the Hecla Mill located on Canyon Creek at Burke.

The mill water supply is diverted from Canyon Creek above Burke, and the mill wastes are piped some six miles down the valley to three large tailings ponds. The overflow from these ponds is discharged into Canyon Creek.

Above Burke, Canyon Creek is a clear mountain stream. Below Burke, the bottom and banks are red with iron stain. The source of the iron is believed to come from acid mine water from the abandoned Hecla Mine at Burke. Samples from Canyon Creek above and below Burke show a significant increase in iron in this reach of the stream.

Old mill tailings underlie a large part of the valley floor below Burke. Ground water flowing through these materials pick up substantial quantities of zinc which is discharged into Canyon Creek. The effluent from the Hecla tailings ponds has a lower zinc concentration than the adjacent stream.

The sampling stations along Canyon Creek are shown on Figure 3 and the analytical data are given on Table 3.

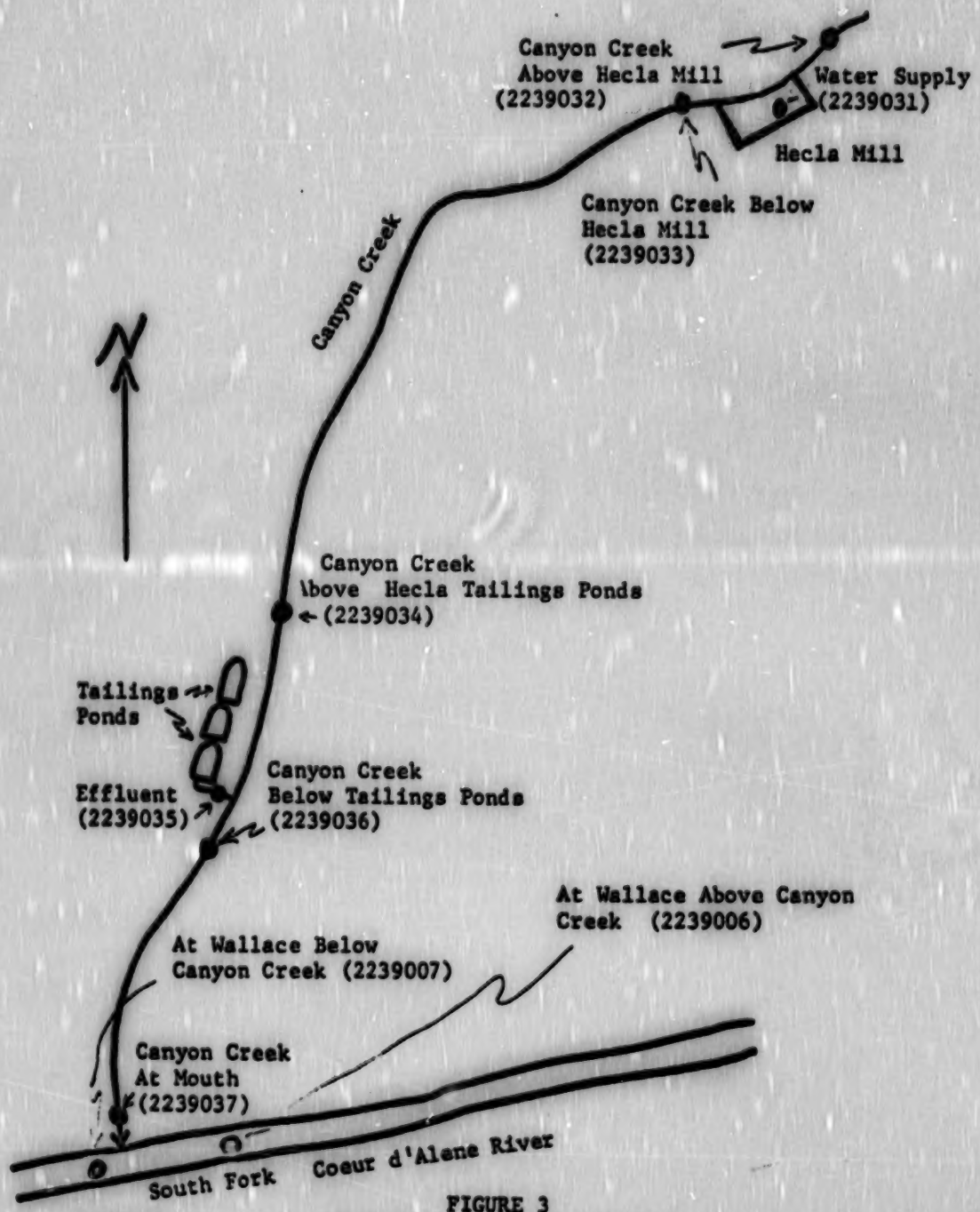

FIGURE 3
SKETCH MAP SHOWING LOCATION
OF SAMPLING STATIONS ON
CANYON CREEK

TABLE 3

ANALYSIS OF EFFLUENT FROM THE HECLA TAILINGS PONDS
AND WATER IN CANYON CREEK
September 22, 1971

Parameter	Water Supply Hecla Mill (2239031)	Canyon Creek Above Hecla Mill (2239032)	Canyon Creek Below Hecla Mill (2239033)
Conductivity, uMHO	25	80	108
pH	6.7	6.9	6.7
Antimony, Total, ug/l	25	40	50
Arsenic, Total, ug/l	< 5	< 5	< 5
Cadmium, Total, ug/l	1	1	2
Chromium, Total, ug/l	3	3	3
Copper, Total, ug/l	2	2	2
Iron, Total, ug/l		250 (7)	2200 (70)
Lead, Total, ug/l	< 5	14 (.4)	48 (1.5)
Mercury, Total, ug/l	.5	< .5	< .5
Zinc, Total, ug/l	18	62	160 (5)
Flow, cfs		5	6

(Load in pounds per day shown in parenthesis)

TABLE 3 - continued

ANALYSIS OF EFFLUENT FROM THE HECLA TAILINGS PONDS
AND WATER IN CANYON CREEK
September 22, 1971

Paremeter	Canyon Creek Above Hecla Tailings Ponds (2239034)	Effluent from Tailings Ponds (2239035)	Canyon Creek Below Tailings Ponds (2239036)	Canyon Creek at Mouth (2239037)
Conductivity, uMHO	130	610	200	220
pH	6.9	6.9	6.8	6.5
Antimony, Total, ug/l	40	80	30	40
Arsenic, Total, ug/l	< 5	< 5	< 5	< 5
Cadmium, Total, ug/l	11	4	13	35
Chromium, Total, ug/l	3	6	3	3
Copper, Total, ug/l	3	1,050 (15)	125 (8)	145 (12)
Iron, Total, ug/l	1,050 (50)			
Lead, Total, ug/l	140	195	140	170
Mercury, Total, ug/l	< .5	< .5	< .5	< .5
Zinc, Total, ug/l	1,630 (78)	780 (11)	1,850 (120)	5,000 (400)
Flow, cfs	8.8	2.6	12	15

(Load in pounds per day shown in parenthesis)

DAYROCK MINE AND MILL

The Dayrock Mine and Mill are operated by Day Mines Inc. and are located on Ninemile Creek some 3 miles north of Wallace. The mine is located just below the confluence of the East and West Fork.

The mill water supply comes from a small reservoir on the West Fork. Most of the water used in the mill is diverted from the East Fork into the reservoir. The mill wastes are discharged into a tailings pond located just east of the mill. Effluent from the tailings pond is discharged to Ninemile Creek.

The East Fork of Ninemile Creek contains a high concentration of zinc. The source is not definitely known, but is believed to be contributed by ground water percolating through old mill tailings that underlie the valley floor upstream from the Dayrock Mine. The waste from the Dayrock tailings pond have a lower concentration of zinc than the receiving stream.

Since most of the mine wastes have been removed from Ninemile Creek, the effects of the raw sewage discharge is plainly visible in the stream. The water is relatively clear but the stream bottom has a bright green color, from apparently algae growth. It is very possible that the removal of the mining waste is creating a public health problem as the streams may now support bacteria that were formally limited due to the toxic nature of the stream. The condition of Ninemile Creek makes it obvious that the elimination of <u>all</u> raw discharges is absolutely necessary.

The location of the sampling stations are shown on Figure 4 and the analytical data are given on Table 4.

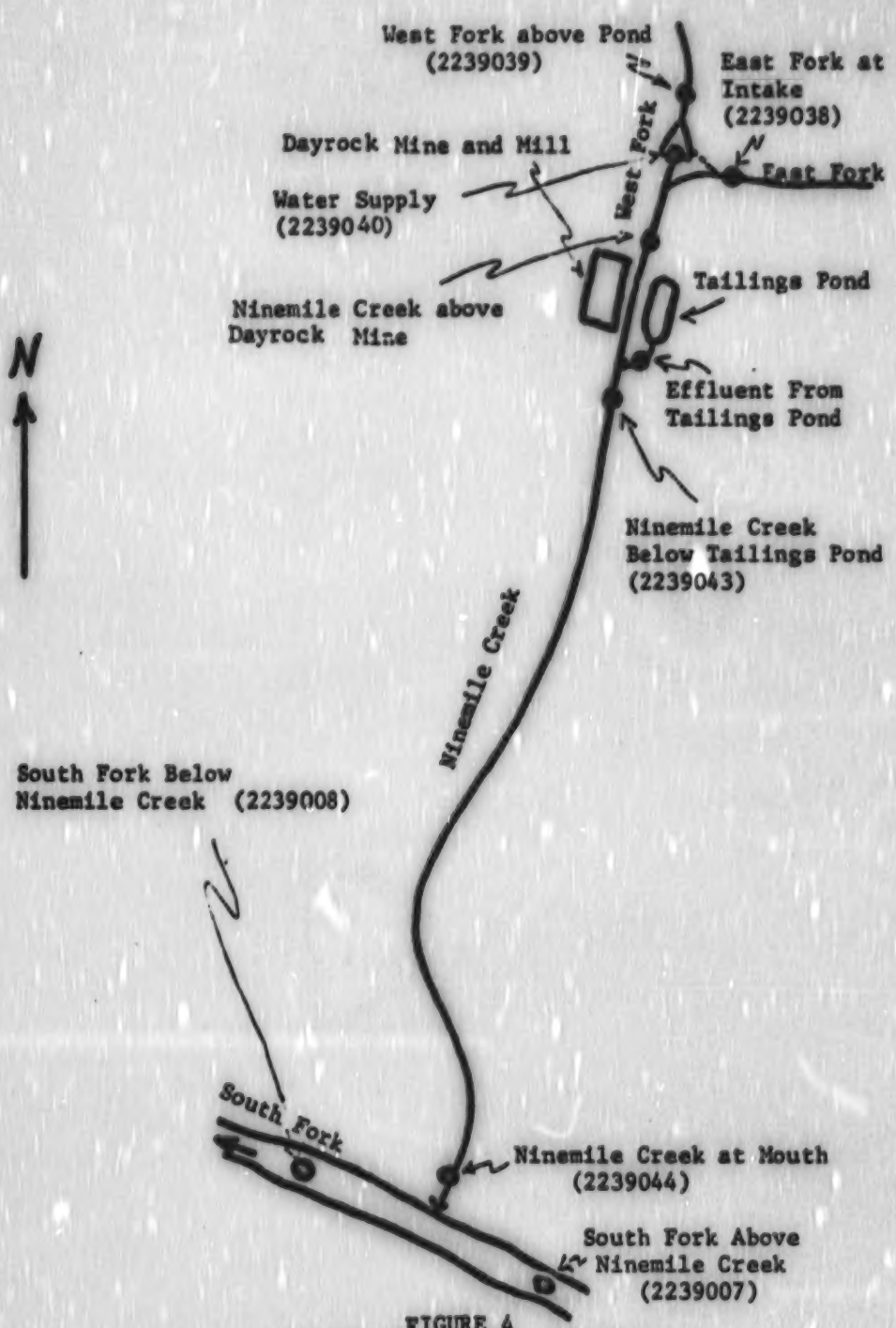

FIGURE 4
SKETCH MAP SHOWING LOCATION
OF SAMPLING STATIONS ON NINEMILE CREEK

TABLE 4

ANALYSIS OF EFFLUENT FROM THE DAYROCK TAILINGS POND
AND WATER IN NINEMILE CREEK
September 22, 1971

Parameter	East Fork Ninemile Creek at Intake to Dayrock Pond (2239038)	West Fork Ninemile Creek above Dayrock Pond (2239039)	Water Supply from Dayrock Pond (2239040)
Conductivity, uMHO	126	265	200
pH	6.8	7.4	6.8
Antimony, Total, ug/1	< 25	40	30
Arsenic, Total, ug/1	< 5	< 5	< 5
Cadmium, Total, ug/1	43	1	17
Chromium, Total, ug/1	3	3	3
Copper, Total, ug/1	22 (.5)	1	5
Lead, Total, ug/1	290 (6)	9	115
Mercury, Total, ug/1	< .5	.5	< .5
Zinc, Total, ug/1	6,800 (143)	14	3,200
Flow, cfs	3.9	.3	

(Load in pounds per day shown in parenthesis)

TABLE 4 continued

ANALYSIS OF EFFLUENT FROM THE DAYROCK TAILINGS POND
AND WATER IN NINEMILE CREEK
September 22, 1971

Parameter	Ninemile Creek Above Dayrock Mill (2239041)	Effluent From Dayrock Tailings Pond (2239042)	Ninemile Creek Below Dayrock Tailings Pond (2239043)	Ninemile Creek At Mouth (2239044)
Conductivity, uMHO	130	408	158	155
pH	6.5	7.2	6.5	6.5
Antimony, Total, ug/l	25	80	30	30
Arsenic, Total, ug/l	< 5	< 5	< 5	< 5
Cadmium, Total, ug/l	43	4	43	33
Chromium, Total, ug/l	4	4	3	3
Copper, Total, ug/l	18 (.4)	6	17 (.4)	10 (.3)
Lead, Total, ug/l	285 (6)	230 (.1)	315 (7)	230 (6)
Mercury, Total, ug/l	< .5	< .5	< .5	< .5
Zinc, Total, ug/l	5800 (143)	500 (.2)	6800 (143)	5200 (140)
Flow, cfs	3.9	.1	3.9	5

(Load in pounds per day shown in parenthesis)

GALENA MINE AND MILL

The Galena Mine and Mill are located on Lake Creek just west of Wallace and are operated by the American Smelting and Refining Co.

The mill water supply comes from Lake Creek and is diverted above the mill. The mine water and mill wastes are discharged into one of four tailings ponds located in the Lake Creek Valley below the mill. The effluent from these ponds can be pumped back to the mill for reuse in watershort periods. Normally however, the effluent flows through two small clarifying ponds prior to its return to Lake Creek.

The location of the sampling stations at the Galena Mill and on Lake Creek are shown on Figure 5 and the analytical data are given on Table 5.

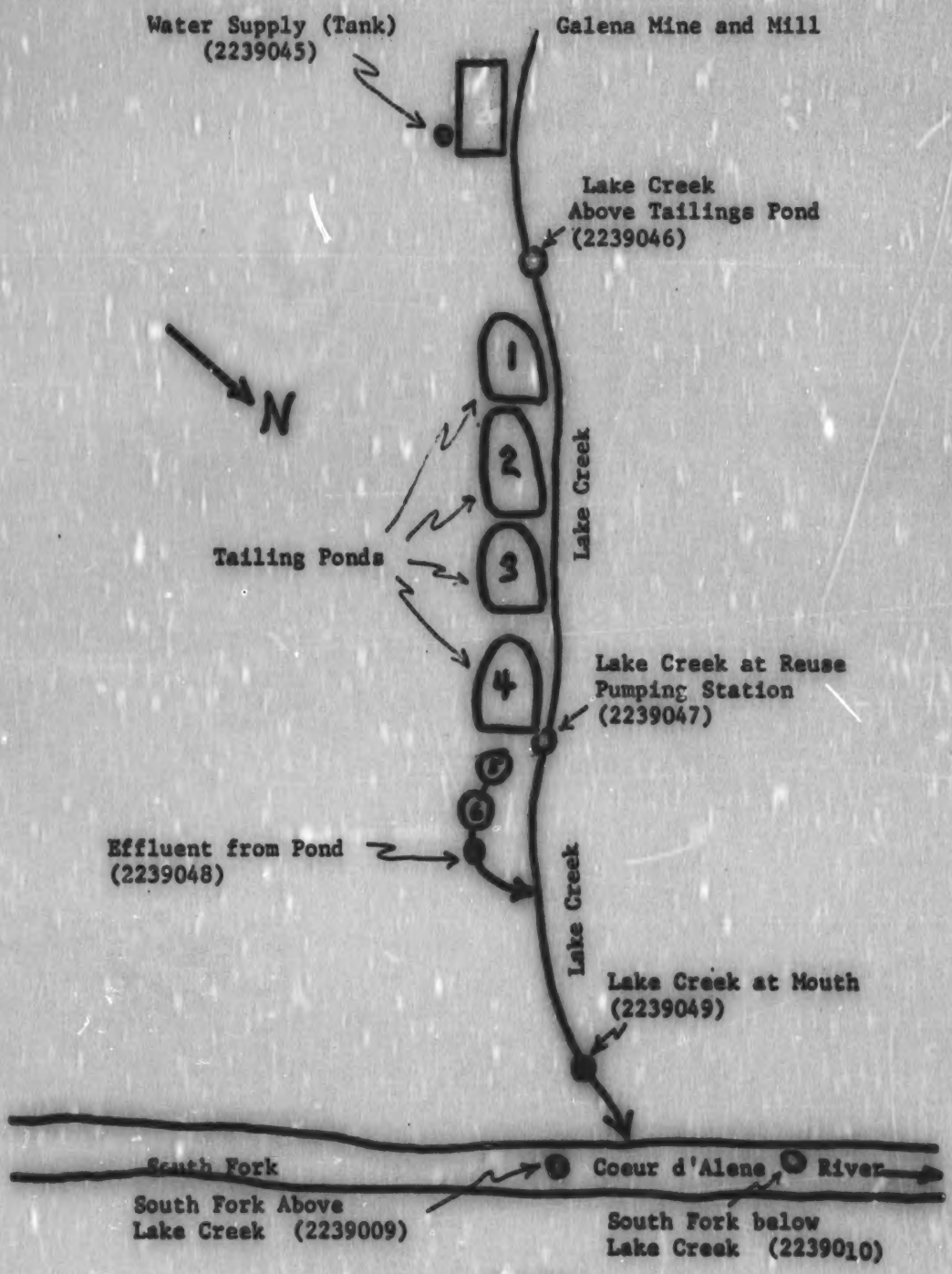

FIGURE 5
SKETCH MAP SHOWING LOCATION
OF SAMPLING STATIONS ON LAKE CREEK

TABLE 5
ANALYSIS OF EFFLUENT FROM THE GALENA TAILINGS PONDS AND WATER IN LAKE CREEK
September 22, 1971

Parameter	Water Supply Galena Mill (2239045)	Lake Creek Below Mill (2239046)	Lake Creek At Reuse Pumping Station (2239047)	Effluent From Clarifier (2239048)	Lake Creek At Mouth (2239049)
Conductivity, uMHO	70	190	280	400	340
pH	6.3	6.2	6.6	6.7	6.2
Antimony, Total, ug/l	50	-	60	90	50
Arsenic, Total, ug/l	-	23	5	25	6
Cadmium, Total, ug/l	1	2	1	1	1
Chromium, Total, ug/l	3	3	3	3	3
Copper, Total, ug/l	10	46	5	320	60 (.4)
Lead, Total, ug/l	5	7	12	7	7
Mercury, Total, ug/l	.5	.5	.5	.5	.5
Zinc, Total, ug/l	-	200	84	42	74 (.5)
Flow, cfs					1.2

(Load in pounds per day shown in parenthesis)

CONSOLIDATED SILVER MINE

The Hecla Mining Company is undertaking exploration work at the Consolidated Silver Mine. The mine is located along the south side of the Coeur d'Alene Valley near Osborn. There is an old mill at the mine but it is not in use.

The waste from this operation consists of mine water and sanitary wastes from the mine office and showers. The water supply comes from wells located on the valley floor north of the mine.

The wastes are piped north across the Coeur d'Alene Valley and are discharged into the South Fork opposite the mouth of Terror Gulch.

The location of the sampling stations are shown on Figure 6 and the analytical data are given in Table 6. The effluent, which is largely mine water, has a lower concentration of metals than the ground water pumped from the valley.

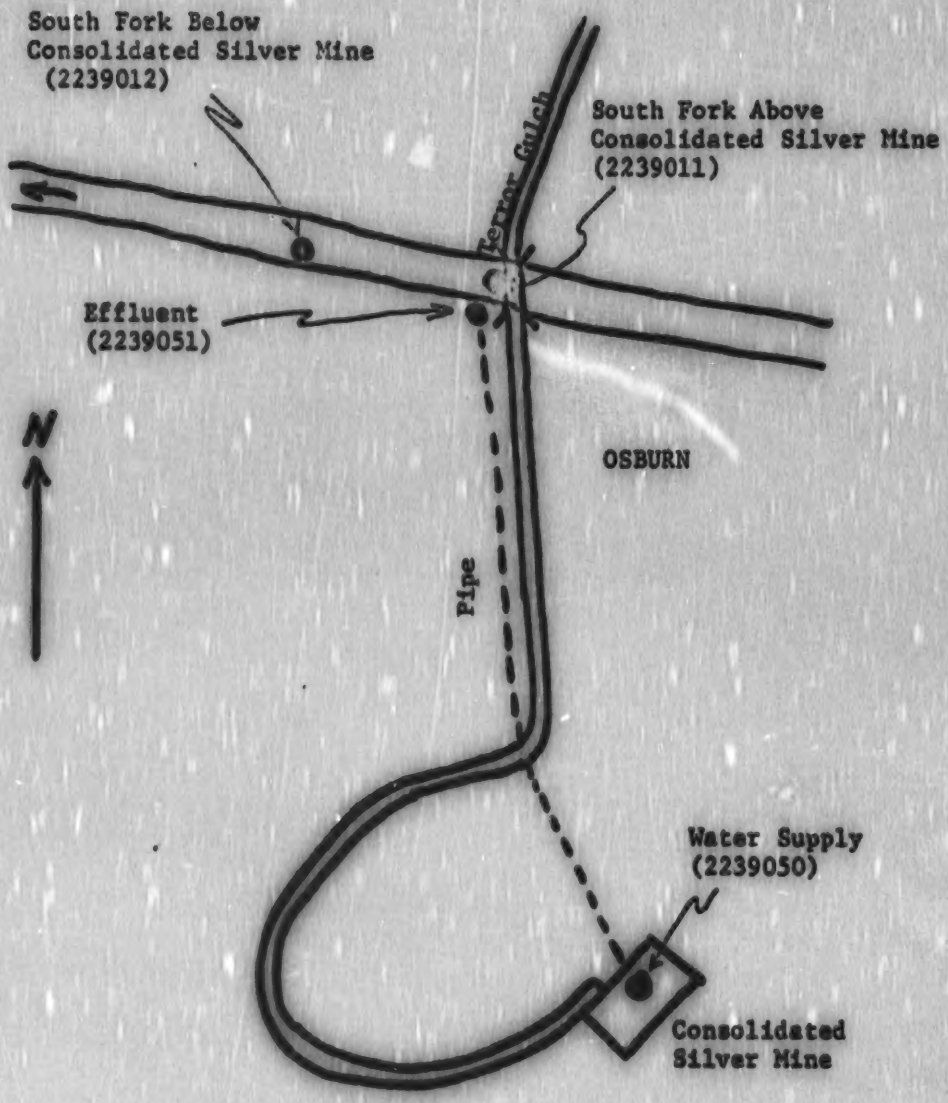

FIGURE 6

SKETCH MAP SHOWING LOCATION
OF SAMPLING STATIONS AT THE
CONSOLIDATED SILVER MINE

TABLE 6

ANALYSIS OF WATER AND EFFLUENT FROM THE
CONSOLIDATED SILVER MINE
September 22, 1971

Parameter	Water Supply From Wells (2239050).	Effluent From Mine and Facilities (2239051)
Conductivity, uMHO	180	160
pH	6.5	6.5
Antimony, Total, ug/l	30	40
Arsenic, Total, ug/l	< 5	< 5
Cadmium, Total, ug/l	1	1
Chromium, Total, ug/l	3	2
Copper, Total, ug/l	22	4
Lead, Total, ug/l	22	7
Mercury, Total, ug/l	< .5	< .5
Zinc, Total, ug/l	1,000	18

SUNSHINE AND CRESENT MINES

The Sunshine Mining Company operates the Sunshine Mine and Mill on Big Creek approximately 3 miles south east of Kellogg. The water supply for the mill is diverted from Big Creek and the effluent from the mill is piped to a large tailings pond located near the mouth of Big Creek. The waste is highly alkaline and is treated with "Separan" to improve its settling characteristics.

The tailings pond effluent is discharged into Big Creek about a thousand feet above the mouth. There is also considerable leakage through the dike and this waste stream discharges into Big Creek near the mouth.

The Cresent Mine is located between the Sunshine Mine and the Sunshine Tailings Pond. It is operated by the Bunker Hill Company. The ore from the Cresent Mine is milled at the Bunker Hill Mill at Kellogg, but mine water is discharged into Big Creek at the mine.

The location of the sampling stations are shown on Figure 7 and the analytical data are given in Table 7.

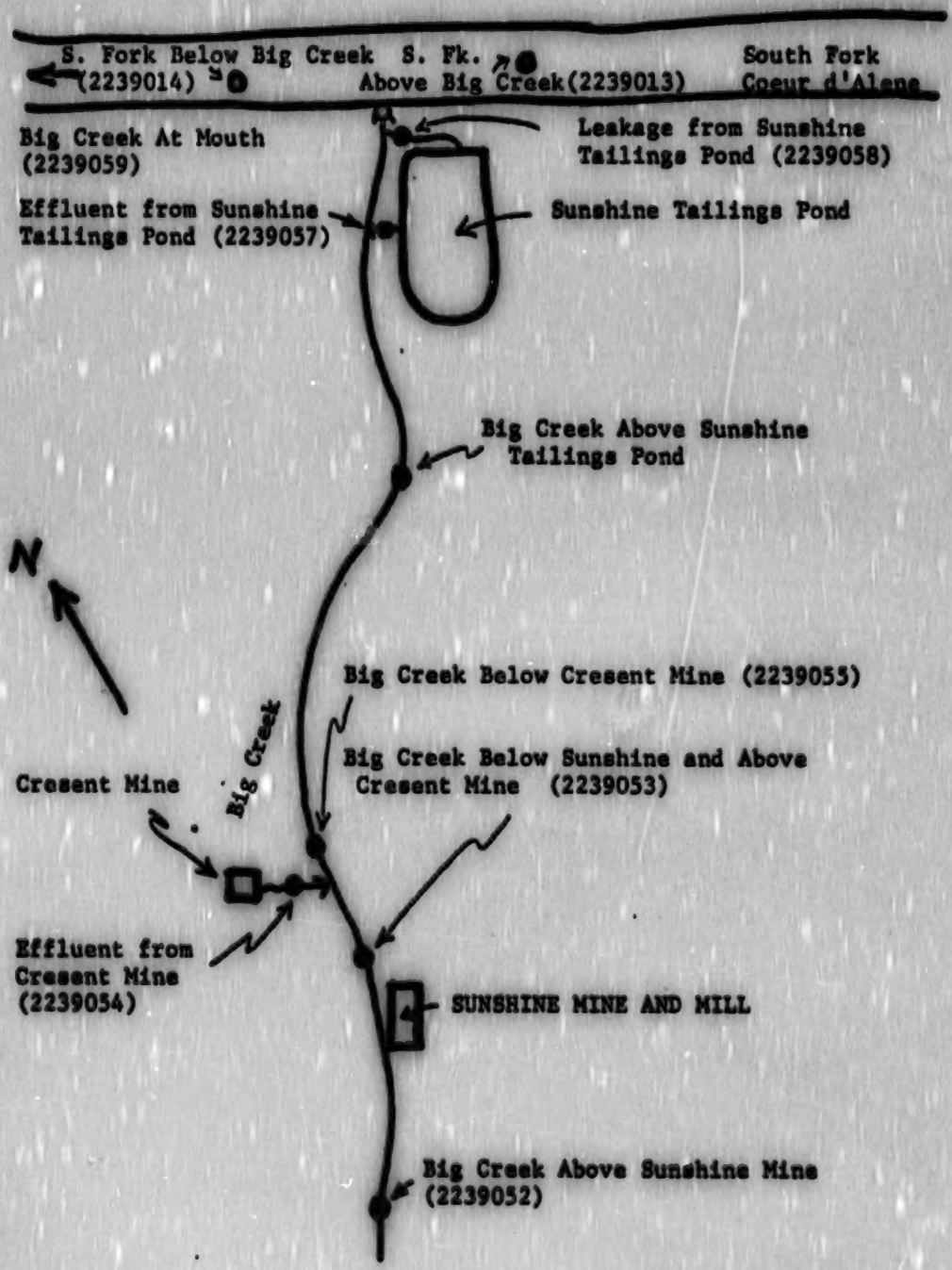
S. Fork Below Big Creek (2239014)
S. Fk. Above Big Creek(2239013)
South Fork Coeur d'Alene
Big Creek At Mouth (2239059)
Leakage from Sunshine Tailings Pond (2239058)
Effluent from Sunshine Tailings Pond (2239057)
Sunshine Tailings Pond
Big Creek Above Sunshine Tailings Pond
N
Big Creek Below Cresent Mine (2239055)
Big Creek
Big Creek Below Sunshine and Above Cresent Mine (2239053)
Cresent Mine
Effluent from Cresent Mine (2239054)
SUNSHINE MINE AND MILL
Big Creek Above Sunshine Mine (2239052)

FIGURE 7
SKETCH MAP SHOWING LOCATION
OF SAMPLING STATIONS ON BIG CREEK

TABLE 7

ANALYSIS OF WATER IN BIG CREEK AND EFFLUENTS
FROM THE SUNSHINE AND CRESENT MINES
September 22, 1971

Parameter	Big Creek Above Sunshine Mine (2239052)	Big Creek Below Sunshine and Above Cresent Mine (2239053)	Effluent From Cresent Mine (2239054)	Big Creek Below Cresent Mine (2239055)
Conductivity, uMHO	60	64	195	70
pH	6.4	6.2	6.4	6.5
Antimony, Total, ug/l	25	40	160	30
Arsenic, Total, ug/l	< 5	< 5	49	< 5
Cadmium, Total, ug/l	1	1	1	1
Chromium, Total, ug/l	2	2	5	3
Copper, Total, ug/l	2	2	470	13
Lead, Total, ug/l	5	5	60	5
Mercury, Total, ug/l	< .5	< .5	< .5	< .5
Zinc, Total, ug/l	14	24	90	12
Flow, cfs		14	1	

(Load in pounds per day shown in parenthesis)

TABLE 7 continued

ANALYSIS OF WATER IN BIG CREEK AND EFFLUENTS
FROM THE SUNSHINE AND CRESENT MINES
September 22, 1971

Parameter	Big Creek Above Sunshine Tailings Pond (2239056)	Effluent from Sunshine Tailings Pond (2239057)	Leakage From Sunshine Tailings Pond (2239058)	Big Creek At Mouth (2239059)
Conductivity, uMHO	85	> 1,000	> 1,000	205
pH	6.2	10	8.6	6.9
Antimony, Total, ug/l	30	14,500 (7)	15,500 (25)	650 (56)
Arsenic, Total, ug/l	5	3,000 (1.5)	2,960 (5)	200 (17)
Cadmium, Total, ug/l	< 1	< 1	1	1
Chromium, Total, ug/l	3	6	6	4
Copper, Total, ug/l	4	39	4	4
Lead, Total, ug/l	< 5	20	9	< 5
Mercury, Total, ug/l	< .5	3	< .5	< .5
Zinc, Total, ug/l	10	98	19	10
Flow, cfs		.1	.3	16

(Load in pounds per day shown in parenthesis)

REED TUNNEL

The Upper workings of the Bunker Hill Mine are operated by way of the Reed Tunnel located along Milo Creek above Wardner. The ore is processed at Kellogg but mine water is discharged to Milo Creek at the mine.

During our examination, the entire flow of Milo Creek was diverted above the Reed Tunnel for domestic use. The flow of Milo Creek flowing through Wardner came almost entirely from Reed Tunnel. In its passage through town the flow is augmented by numerous raw sewage discharges that dilute the concentration of metals in the stream.

Milo Creek is highly acid and the bed is iron stained. The stream appears to be toxic to algae and may also be toxic to some bacteria.

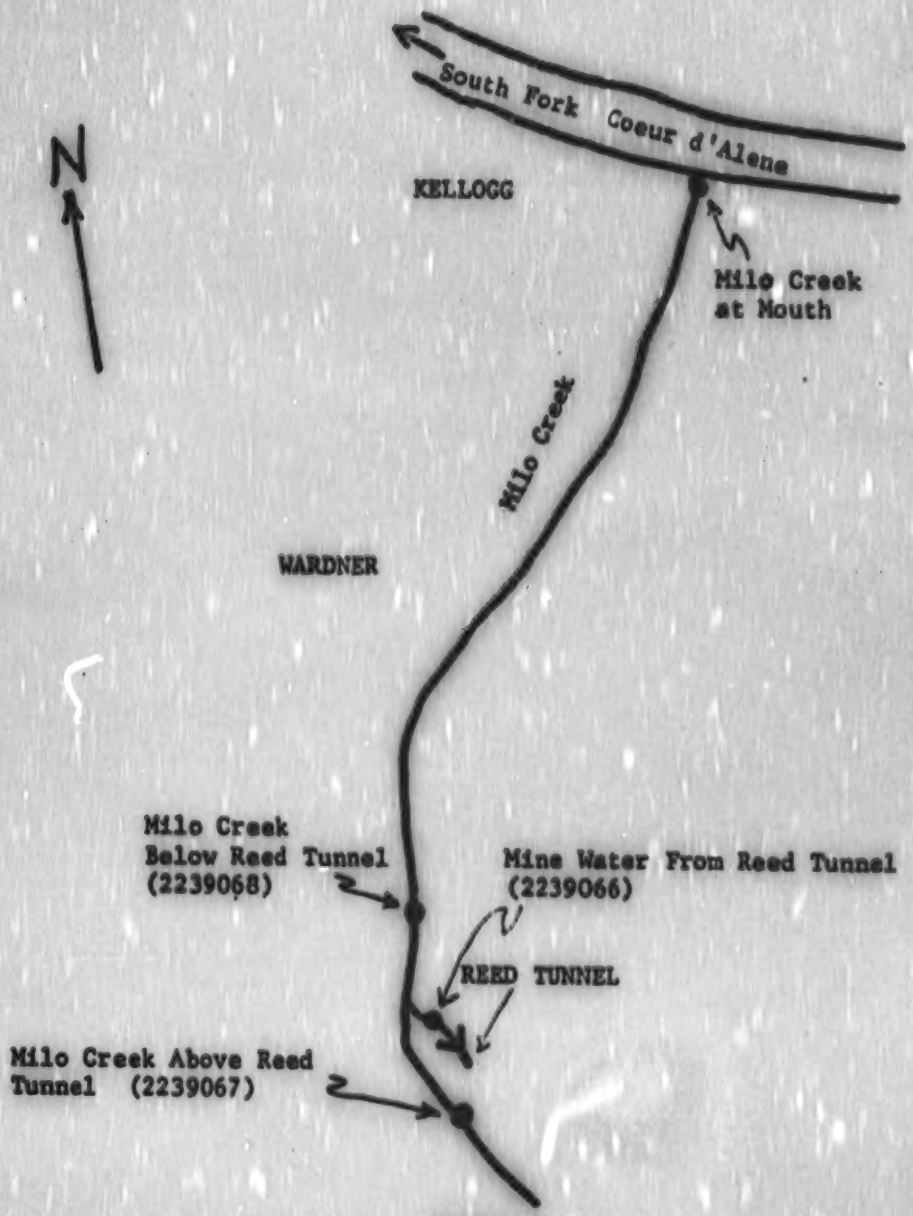

FIGURE 8
SKETCH MAP SHOWING LOCATION
OF SAMPLING STATIONS ON
MILO CREEK

TABLE 8

ANALYSIS OF EFFLUENT FROM REED TUNNEL
AND WATER IN MILO CREEK

Parameter	Milo Creek Above Reed Tunnel (2239067)	Mine Water From Reed Tunnel (2239066)	Milo Creek Below Reed Tunnel (2239068)	Milo Creek at Mouth (2239060)
Conductivity, uMHO	20	475	380	160
pH	6.1	3.2	3.3	5.5
Antimony, Total, ug/l	60	60	50	30
Arsenic, Total, ug/l	< 5	74	72	< 5
Cadmium, Total, ug/l	< 1	54	44	14
Chromium, Total, ug/l	3	4	5	4
Copper, Total, ug/l	7	60	51	10
Lead, Total, ug/l	14	2,500	2,500	365
Mercury, Total, ug/l	< .5	3	2.5	< .5
Zinc, Total, ug/l	52	18,800	14,000	5,000 (32)
Flow, cfs				1.2

(Load in pounds per day shown in parenthesis)

BUNKER HILL OPERATIONS

The Bunker Hill Company operates a mine, a mill, a lead smelter, a zinc plant, a sulfuric acid plant, and a fertilizer plant in the Kellogg-Smelterville area. This complex has three major effluent streams: (1) the effluent from the Central Impoundment area which is discharged directly to the South Fork of the Coeur d'Alene River, (2) the zinc plant effluent which is discharged to Silver King Creek in Government Gulch and (3) the lead smelter effluent, which is also discharged into Silver King Creek.

The Central Impoundment Area receives waste from the mine, the mill, and the fertilizer plant. One waste stream from the zinc plant was recently diverted to the impoundment area to reduce mercury discharges.

During this survey, mine water from the Kellogg Tunnel was temporarily bypassing the impoundment area while a new pipe from the mine was being installed. This waste stream was being discharged into the South Fork via Bunker Creek.

The impoundment area does an excellent job in removing the suspended material from the waste and in reducing mercury discharges. The analysis for this waste stream in Table 9 is from a 24-hour composite and shows about .1 pound per day of mercury being discharged from the source. In contrast, this waste stream is a major contributor of zinc to the South Fork. The same composite sample showed more than 5000 pounds per day of zinc in this waste stream.

The lead smelter waste is discharged to Silver King Creek by way of Sweeney Pond. Silver King Creek above Sweeney Pond is essentially a waste stream from the zinc plant. Analysis of the effluent from Sweeney Pond and Silver King Creek above Sweeney Pond are given on Table 9. This shows that about 4000 pounds per day of zinc is contributed to the South Fork from Bunker Hill operations along Silver King Creek.

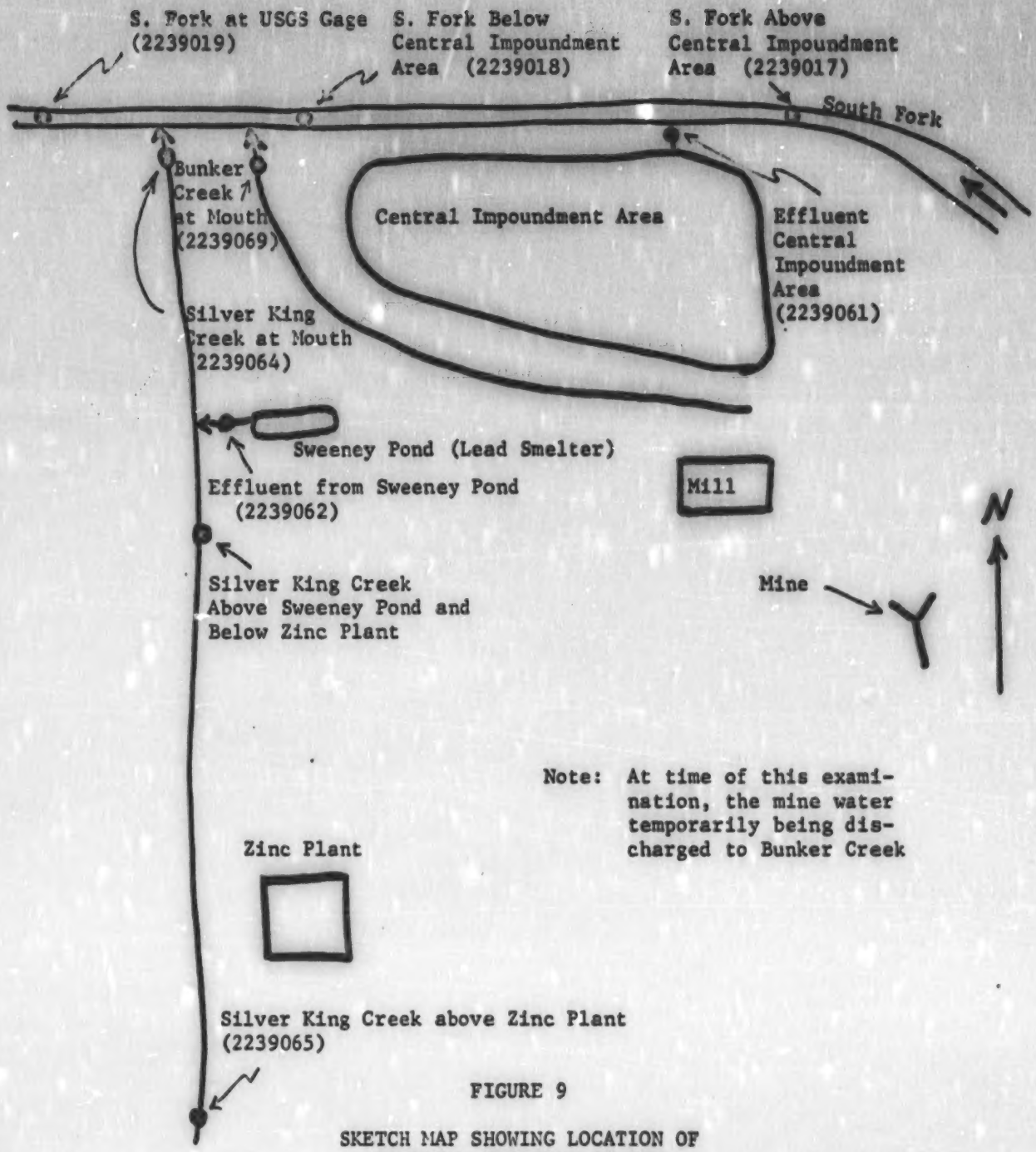
S. Fork at USGS Gage (2239019)
S. Fork Below Central Impoundment Area (2239018)
S. Fork Above Central Impoundment Area (2239017)
South Fork
Bunker Creek at Mouth (2239069)
Central Impoundment Area
Effluent Central Impoundment Area (2239061)
Silver King Creek at Mouth (2239064)
Sweeney Pond (Lead Smelter)
Effluent from Sweeney Pond (2239062)
Mill
N
Silver King Creek Above Sweeney Pond and Below Zinc Plant
Mine
Note: At time of this examination, the mine water temporarily being discharged to Bunker Creek
Zinc Plant
Silver King Creek above Zinc Plant (2239065)

FIGURE 9

SKETCH MAP SHOWING LOCATION OF SAMPLING STATIONS AT THE BUNKER HILL FACILITIES

TABLE 9

ANALYSIS OF EFFLUENTS FROM BUNKER HILL FACILITIES
AND SILVER KING CREEK
September 23, 1971

Parameter	Effluent from Central Impoundment Area (2239061)	Bunker Creek at Mouth (2239069)	Silver King Creek Above Zinc Plant (2239065)
Conductivity, uMHO	> 1,000	> 1,000	45
pH	2.5	4.5	6.3
Antimony, Total, ug/l	200 (7)	80	25
Arsenic, Total, ug/l	340 (11)	1,460	< 5
Cadmium, Total, ug/l	1,020 (34)	70	1
Chromium, Total, ug/l	140 (5)	18	3
Copper, Total, ug/l	690 (23)	470	1
Lead, Total, ug/l	2,500 (84)	5,000	9
Mercury, Total, ug/l	3 (.1)	7	.5
Zinc, Total, ug/l	150,000 (5025)	26,500	75
Flow, cfs	6.2		

(Load in pounds per day shown in parenthesis)

TABLE 9 continued

ANALYSIS OF EFFLUENTS FROM BUNKER HILL FACILITIES
AND SILVER KING CREEK
September 23, 1971

Parameter	Silver King Creek Below Zinc Plant And Above Sweeney Pond (2239063)	Effluent From Sweeney Pond (2239062)	Silver King Creek at Mouth (2239064)
Conductivity, uMHO	> 1,000	190	850
pH	2.6	6.3	3.3
Antimony, Total, ug/l	80 (2.6)	80 (2.5)	100 (9)
Arsenic, Total, ug/l	34 (1)	50 (1.5)	58 (5)
Cadmium, Total, ug/l	1,600 (52)	380 (12)	760 (68)
Chromium, Total, ug/l	14 (.4)	4 (.1)	10 (1)
Copper, Total, ug/l	690 (22)	40 (1.3)	175 (16)
Lead, Total, ug/l	1,200 (29)	2,350 (73)	3,000 (272)
Mercury, Total, ug/l	7 (.2)	2.5 (.1)	5 (.4)
Zinc, Total, ug/l	138,000 (4,460)	7,100 (221)	42,500 (3,850)
Flow, cfs	6	5.8	16.8

(Load in pounds per day shown in parenthesis)

SOUTH FORK COEUR D'ALENE RIVER

Nineteen points along the Coeur d'Alene River from above Mullan to Rose Lake were sampled for analyses. The analytical data for these samples are given in Table 10 and their location is shown on Figure 10.

Zinc is the most prevalent metal in the South Fork. The first major contribution of zinc comes from Canyon Creek at Wallace where some 400 pounds per day is contributed to the stream. The South Fork picks up another 400 pounds per day between Wallace and Kellogg, chiefly from ground water contributions. At Kellogg, some 11,000 pounds per day are contributed by the Bunker Hill operations. The zinc stays in solution and is diluted by the flow from the North Fork.

The loading of various other metals were computed at the USGS gaging station at Smelterville. They show approximately 80 pounds per day of antimony, 92 pounds per day of arsenic, 90 pounds per day of cadmium, 8 pounds per day of chromium, 60 pounds per day of copper, 770 pounds per day of lead, and 1/2 pound per day of mercury. The load of copper, lead and mercury decreases downstream from Smelterville and the load of antimony, cadmium, and chromium increases downstream, probably from ground water inflow.

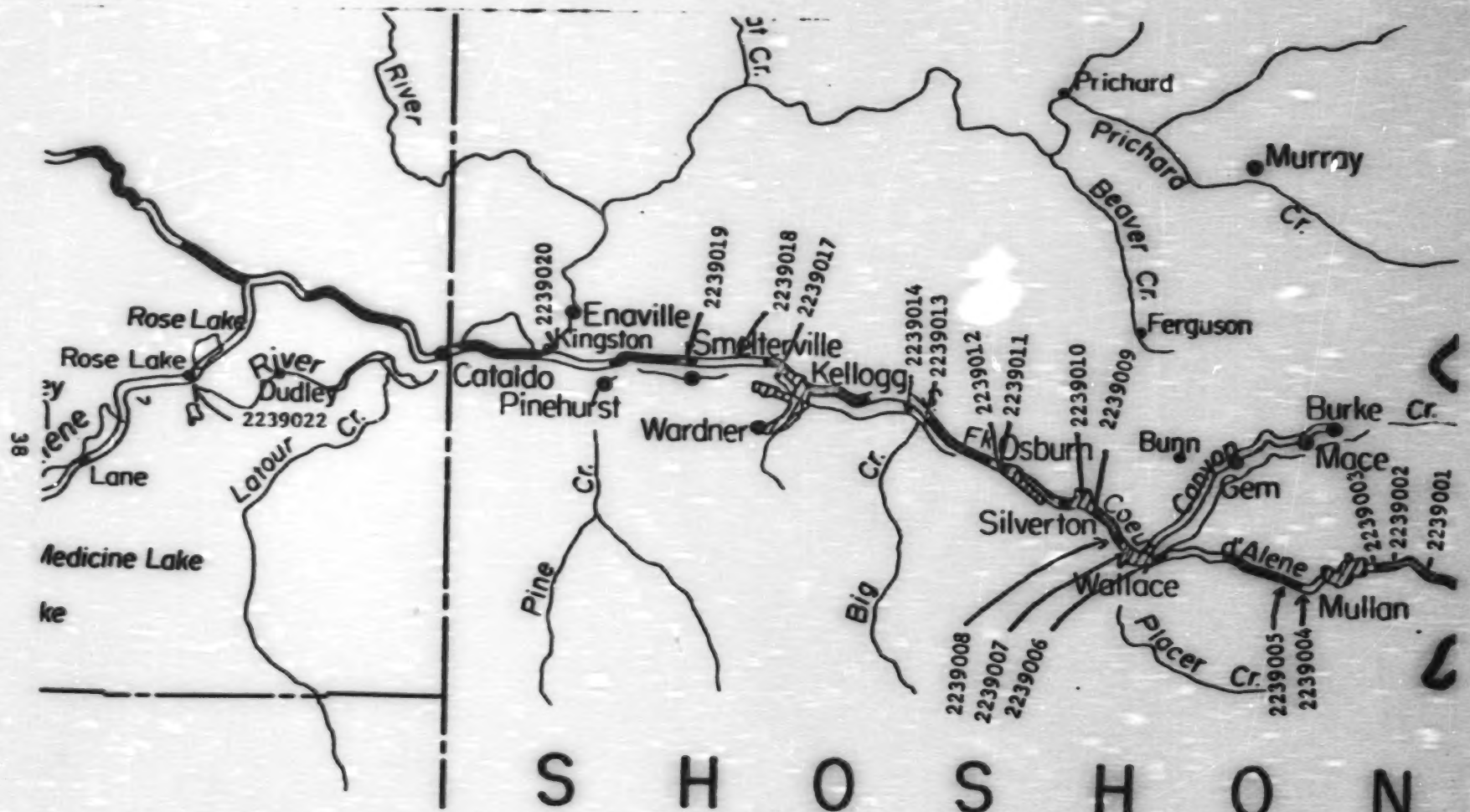

FIGURE 10

MAP OF THE COEUR D'ALENE RIVER SHOWING THE LOCATION OF SAMPLING STATIONS

TABLE 10

ANALYSIS OF WATER FROM THE COEUR D'ALENE RIVER FROM ABOVE MULLAN TO ROSE LAKE
September 22, 1971

Parameter	Above Mullan (2239001)	At Mullan Below Discharge From Lucky Friday Mine (2239002)	At Mullan Above Lucky Friday Tailings Pond (2239003)	Below Lucky Friday Tailings Pond and Above Morning Mine (2239004)
Conductivity, uMHO	95	125	115	120
pH	6.9	8.0	8.2	7.7
Antimony, Total, ug/l	30	30	30	40
Arsenic, Total, ug/l	< 5	< 5	< 5	< 5
Cadmium, Total, ug/l	1	1	1	1
Chromium, Total, ug/l	2	2	2	1
Copper, Total, ug/l	5	5	5	3
Lead, Total, ug/l	7	27	33	12
Mercury, Total, ug/l	< .5	< .5	< .5	< .5
Zinc, Total, ug/l	9	27	39	60
Flow, cfs				

(Load in pounds per day shown in parenthesis)

TABLE 10 continued

ANALYSIS OF WATER FROM THE COEUR D'ALENE
RIVER FROM ABOVE MULLAN TO ROSE LAKE
September 22, 1971

Parameter	Below Morning Mine (2239005)	At Wallace Above Mouth of Canyon Creek (2239006)	At Wallace Below Canyon Creek and Above Ninemile Creek (2239007)	Below Mouth of Ninemile Creek (2239008)
Conductivity, uMHO	135	125	170	170
pH	7.9	8.1	7.8	7.5
Antimony, Total, ug/l	40	40 (6)	40	40
Arsenic, Total, ug/l	< 5	< 5	< 5	< 5
Cadimum, Total, ug/l	1	1	13	14
Chromium, Total, ug/l	1	1	1	3
Copper, Total, ug/l	3	3 (.5)	39	51
Lead, Total, ug/l	17	14	48	90
Mercury, Total, ug/l	< .5	< .5	< .5	< .5
Zinc, Total, ug/l	210	300 (49)	1,800	2,300
Flow, cfs		30		

(Load in pounds per day shown in parenthesis)

TABLE 10 continued

ANALYSIS OF WATER FROM THE COEUR D'ALENE RIVER
FROM ABOVE MULLAN TO ROSE LAKE
September 22, 1971

Parameter	Above Mouth of Lake Creek (2239009)	Below Mouth Of Lake Creek (2239010)	Above Consolidated Silver Mine (2239011)	Below Consolidated Silver Mine (2239012)
Conductivity, uMHO	180	180	155	165
pH	6.4	6.4	8.1	6.9
Antimony, Total, ug/l	30 (9)	40	40 (18)	30
Arsenic, Total, ug/l	< 5	< 5	< 5	< 5
Cadmium, Total, ug/l	11 (3)	10	7 (3)	8
Chromium, Total, ug/l	1	3	2 (1)	4
Copper, Total, ug/l	35 (10)	38	37 (17)	37
Lead, Total, ug/l	61 (18)	82	150 (69)	155
Mercury, Total, ug/l	.5	< .5	< .5	< .5
Zinc, Total, ug/l	1,550 (451)	1,450	900 (412)	900
Flow, cfs	54		85	

(Load in pounds per day shown in parenthesis)

TABLE 10 continued

ANALYSIS OF WATER FROM THE COEUR D'ALENE RIVER
FROM ABOVE MULLAN TO ROSE LAKE
September 22, 1971

Parameter	Above Mouth of Big Creek (2239013)	Below Mouth of Big Creek (2239014)	Above Bunker Hill Impoundment Facility (2239017)	Below Bunker Hill Impoundment Facility (2239018)
Conductivity, uMHO	165	180	290	600
pH	6.5	6.7	6.5	4.7
Antimony, Total, ug/l	40	100 (54)	60	130
Arsenic, Total, ug/l	< 5	56 (30)	21	44
Cadmium, Total, ug/l	14	9 (5)	15	80
Chromium, Total, ug/l	3	3 (1.6)	2	11
Copper, Total, ug/l	27	18 (10)	24	65
Lead, Total, ug/l	66	48 (26)	75	360
Mercury, Total, ug/l	< .5	< .5	< .5	< .5
Zinc, Total, ug/l	2,300	1,630 (880)	1,700	13,600
Flow, cfs		100		

(Load in pounds per day shown in parenthesis)

TABLE 10 continued

ANALYSIS OF WATER FROM THE COEUR D'ALENE RIVER
FROM ABOVE MULLAN TO ROSE LAKE
September 22, 1971

Parameter	At USGS Gage Below Silver King Creek (2239019)	At Enaville Bridge (2239020)	At Rose Lake Below North Fork (2239022)
Conductivity, uMHO	440	480	205
pH	5.3	5.4	6.3
Antimony, Total, ug/l	130 (83)	110 (94)	50 (135)
Arsenic, Total, ug/l	144 (92)	44 (37)	7 (19)
Cadmium, Total, ug/l	145 (93)	120 (102)	60 (162)
Chromium, Total, ug/l	13 (8)	9 (8)	4 (11)
Copper, Total, ug/l	90 (58)	46 (39)	10 (27)
Lead, Total, ug/l	1,200 (770)	480 (409)	80 (216)
Mercury, Total, ug/l	1 (.6)	<.5	<.5
Zinc, Total, ug/l	18,500 (11,880)	15,000 (12,780)	4,200 (11,340)
Flow, cfs	119	158	501

(Load in pounds per day shown in parenthesis)